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FORM PTO-1449 (modified)  
 To: U.S. Department of Commerce  
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Atty. Dkt. No.	Minh 273686	Credit Ref.
		FOO-219-US-DIV-3

## INFORMATION DISCLOSURE STATEMENT BY APPLICANT

Date: OCTOBER 2, 2000

Page 1 of 5

Applicant: MANABE et al.

Div. of Appln. No.: 09/417,778

Filing Date: October 14, 1999

Examiner: Minh Loan Tran Group Art Unit: 2811

**U.S. PATENT DOCUMENTS**

Examiner's Initials*	Document Number	Date MM/YYYY	Name (Family Name of First Inventor)	Class	Sub Class	Filing Date (if appropriate)
AR	5,278,433	1/1994	Manabe et al.			
BR	4,844,989	07/89	Murdock			
CR	4,408,217	10/83	Kobayashi			
DR	4,268,842	05/81	Jacob et al.			
ER	5,005,057	04/91	Izumiya et al.			
FR	4,614,961	09/86	Khan et al.			
GR	4,153,905	05/79	Charmakedze et al.			
HR	4,855,249	08/89	Akasaki et al.			
IR	4,911,102	03/90	Manabe et al.			
JR	4,945,548	08/90	Kotaki et al.			
KR	4,396,929	08/83	Ohki et al.			
LR	5,006,908	04/91	Natsuoka et al.			
MR	4,608,581	08/86	Bagratishvili et al.			
NR	4,473,938	10/84	Kobayashi et al.			

**FOREIGN PATENT DOCUMENTS**

	Document Number	Date MM/YYYY	Country	Inventor Name	Class	SubClass	English Abstract		Translation Readily Available	
							Enclosed	No	Enclose	No
OR	2-229475	09/1990	Japan					x		x
PR	2-275682	11/1990	Japan					x		x
QR	5-042785	04/1975	Japan					x		x
RR	59-228776	12/1994	Japan					x		x
SR	0 620 203 A1	10/1994	Europe	Nakahata				x		x
TR	0-277597	08/1988	EPA					x		x
UR	03-034549	02/1991	Japan	Toyoda				x		x
VR	34549	02/1991	Japan	Hatano				x		x
WR	4,006,449	09/1990	Germany	Manabe				x		x
XR	57-018377	01/1982	Japan	KOBAYASHI				x		x

**OTHER (Including in this order: Author, Title, Periodical Name, Date, Pertinent Pages, etc.)**

YR	English Abstract of OKI Japanese Application Published 9/22/82 under No. 57-153479.
ZR	I. Akasaki et al., "Effects of AlN Buffer Layer on Crystallographic Structure... by MOVPE", J. Crystal Growth 98 (1989) pp. 209-19.
AAR	Liu et al., "Growth morphology and surface-acoustic-wave measurements of AlN films on Sapphire," Journal of Applied Physics, Vol. 46, No. 9, September 1975, pages 3703-3706.
BBR	Ilegems et al. "Electrical properties of n-Type Vapor-growth Gallium Nitride", J. Phys. Chem. solids., 1973, V 1. 34, pp. 885-895.

Examiner

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\*EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

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Page 2 of 5

**U.S. PATENT DOCUMENTS**

Examiner's Initials*	Document Number	Date MM/YYYY	Name (Family Name of First Inventor)	Class	Sub Class	Filing Date (If appropriate)
AR	5,218,216	06/1993	Manabe			
BR	5,247,533	09/1993	Okazaki et al.			
CR	5,205,905	04/1993	Kotaki et al.			
DR	5,079,184	01/1992	Hatano et al.			
ER	5,076,860	12/1991	Ohba et al.			
FR						
GR						
HR						
IR						
JR						
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**FOREIGN PATENT DOCUMENTS**

	Document Number	Date MM/YYYY	Country	Inventor Name	Class	SubClass	English Abstract		Translation Readily Available	
							Enclosed	No	Enclose	No
MR	58-012381	01/1983	Japan	Yoneda				x		x
NR	61-007671	01/1986	Japan	Kawabata				x		x
OR	57-087184	05/1982	Japan	Tabuchi				x		x
PR	57-153479	09/1982	Japan	Ooki				x		x
QR	2-738329	03/1978	Germany	Jacob et al.				x		x
RR	56-59699	05/1981	Japan	Ooki				x		x
SR	34549	02/1991	Japan	Hatano				x		x
TR	3-046018	09/1981	Germany	Kobayashi et al.				x		x

**OTHER (including in this order: Author, Title, Periodical Name, Date, Pertinent Pages, etc.)**

UR	Koide et al. "Effect of an AlN Buffer layer on AlGaN-Al2O3 Heteroepitaxial Growth by MOVPE", Japanese Journal of Crystal Growth 1986, Vol. 13, No. 4, pp. 218-225.			
VR	Sayyah et al. "The Influence of TMA and SiH4 on the Incorporation Rate of Ga <sub>x</sub> Al <sub>1-x</sub> N Crystals Grown from TMG and NH <sub>3</sub> ", Journal of Crystal Growth 77 (1986), pp. 424-429 North-Holland, Amsterdam.			
WR	Bottka, et al., Silicon and beryllium doping of OMVPE Grown..., Journal of Crystal Growth 68 (1984) pp. 54-59, North-Holland Amsterdam			
XR	Madar et al., "Growth Anisotropy in the CaN/Al <sub>2</sub> O <sub>3</sub> System," Journal of Crystal Growth 40, 1997, pages 239-252.			
YR	Koide et al., "Epitaxial Growth and Properties of Al <sub>x</sub> Ga <sub>1-x</sub> N by MOVPE, Reprinted from Journal of the Electrochemical Society, Vol. 133, No. 9, September 1996, pp. 1956-1960			
ZR	Boulou et al., "Light emitting Diodes Based on GaN", Philips Tech. Rev., 37, 237-240 No. 9/10, 1977.			

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273686

FOO-219-US-DIV-3

Applicant: MANABE et al.

Div of Appln. No.: 09/417,778

Filing Date: October 14, 1999

Examiner: Minh Loan Tran Group Art Unit: 2811

Date: October 2, 2000

Page 3 of 5

## U.S. PATENT DOCUMENTS

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AR						
BR						
CR						
DR						
ER						
FR						
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## FOREIGN PATENT DOCUMENTS

	Document Number	Date MM/YYYY	Country	Inventor Name	Class	SubClass	English Abstract		Translation Readily Available	
							Enclosed	No	Enclose	No
MR	49-29771	7/1972	Japan	Kasano				X		X
NR	2623466	2/1990	Japan	Sassa et al.				X		X
OR	59-228776	6/1983	Japan	Maefutsu et al.				X		X
PR	60-173829	2/1984	Japan	Maefutsu et al.				X		X
QR	1-589351	05/1981	England							
RR	63-188977	08/1988	Japan							
SR	62-119196	05/1987	Japan							
TR	57-046669	10/1982	Japan							
UR	03-034549	02/1991	Japan							
VR	54-071589	06/1979	Japan	Toyoda						

## OTHER (including in this order: Author, Title, Periodical Name, Date, Pertinent Pages, etc.)

WR	English Abstract of OOKI Japanese Application Published 9/19/82 under No. 57-153479.			
XR	I. Akusuki et al., "Effects of AlN Buffer Layer on Crystallographic Structure... by MOVPE", J. Crystal Growth 98 (1989) pp. 209-19.			
YR	Sayyah, A Study of Growth Mechanisms and Electrical and Optical Properties of Epitaxial Al <sub>x</sub> Ga <sub>1-x</sub> N Layers Grown by Atmospheric Pressure Metalorganic Chemical Vapor Deposition, A Dissertation presented to Faculty of the Graduate School, University of Southern California, February 1986, pp. 125-136.			
ZR	K. ide et al., Epitaxial Growth and Properties of Al <sub>x</sub> Ga <sub>1-x</sub> N by MOVPE, J. Electrochem. Soc.: SOLID-STATE SCIENCE AND TECHNOLOGY, Vol. 133, No. 9, September 1986, pp. 1956-1960.			

Examiner

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## **INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

Date: October 2, 2000 Page 4 of 5

**Applicant:** MANABE et al.

**Div. of Appln. No.: 09/417,778**

Filing Date: October 14, 1999

Examiner: Minh Loan Tran Group Art Unit: 2811

# U.S. PATENT DOCUMENTS

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AR						
BR						
CR						
DR						
ER						
FR						
GR						
HR						
IR						
JR						
KR						
LR						

## FOREIGN PATENT DOCUMENTS

**OTHER** (including in this order: Author, Title, Periodical Name, Date, Pertinent Pages, etc.)

	SR	Masakiyo Matsumura, Semiconductor Devices, Chapter 2, Principle of Diodes, 2.1: pn junction and rectification, December 25, 1986, p. 13.		
	TR	Kiyoshi Takahashi, Semiconductor Engineering: Basic Characteristics of Semiconductor, Morikita Electric Engineering Series, Vol. 4, Chapter 14: Semiconductor Material Technics, 14:1: Forming of Semiconductor Material, August 1, 1975, p. 297.		
	UR	Hiroyuki Matsunemi, Semiconductor Engineering, Chapter 2: Basic Characteristics of Semiconductor, March 25, 1983, pp. 18-31.		
	VR	Sano et al., Properties of III-V Nitride Semiconductors, Japanese Journal of Applied Physics, Vol. 52, No. 5, 1983, pp. 374-387.		
	WR	Miyoshi Haradome, Basics of Semiconductor Engineering, Chapter 8: Compound Semiconductor, 8:1, Conditions to be Semiconductor, August 30, 1967, p. 161.		
	XR	A.S. Grove, Physics and Technology of Semiconductor, Chapter 4: Basics of Semiconductor Physics, 1967, translated and published in Japan June 23, 1995, pp. 112-123.		

Examiner

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Applicant: MANABE et al.

Div of Appln. No.: 09/417,778

Filing Date: October 14, 1999

Examiner: Minh Loan Tran Group Art Unit: 2811

Date: OCTOBER 2, 2000 Page 5 of 5

**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

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NR										
OR										
PR										

**OTHER (including in this order: Author, Title, Periodical Name, Date, Pertinent Pages, etc.)**

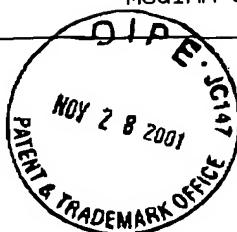
UR	Kazuyo Kadota, The Invention, 39 New Technics Selected by Japan Patent Office; Laser Technics, Vol. 94, No. 9 (the first volume); September 1997, pp. 42-49.			
VR	Pankove et al., Optical Absorption of GaN, Applied Physics Letters, Vol. 17, No. 5, September 1970, pp. 197-198.			
WR	Amano et al., Effects of the Buffer Layer in Metalorganic Vapour Phase Epitaxy of GaN on Sapphire Substrate, Thin Solid Films, 163, (1988), pp. 415-420.			
XR	Akasaki et al., Effects of AlN Buffer Layer on Crystallographic Structure and on Electrical and Optical Properties of GaN and Ga <sub>1-x</sub> Al <sub>x</sub> N(0 < x < 0.4) Films Grown on Sapphire Substrate by MOVPE, Journal of Crystal Growth 98 (1989), pp. 209-219.			
YR	Bottka et al., Silicon and Beryllium Doping of OMVPE Grown Al <sub>x</sub> Ga <sub>1-x</sub> As (x = 0-0.3) Using Silane and Diethylberyllium, Journal of Crystal Growth 68 (1984) pp. 54-59.			
AAR	Hiramatsu et al. "Effects of Buffer Layer in MOVPE Growth of GaN Film on Sapphire Substrate" Japanese Journal of Crystal Growth, 1998, Vol. 15, No. 3&4, pp. 334-342			
BBR	Elwell et al. "Crystal Growth of Gallium Nitride" Prog. Crystal Growth and Charact. 1988, vol. 17, pp. 53-78.			
CCR				
DDR				
EER				

Examiner

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Applicant: MANABE

Appln. No.: 09/677,781

Filing Date: October 2, 2000

Examiner: S. Mulpuri

Group Art Unit: 2812

## INFORMATION DISCLOSURE STATEMENT BY APPLICANT

Date: November 28, 2001

Page 1 of 1

### U.S. PATENT DOCUMENTS

Examiner's Initials*	Document Number	Date MM/YYYY	Name (Family Name of First Inventor)	Class	Sub Class	Filing Date (if applicable)
AR						
BR						
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### FOREIGN PATENT DOCUMENTS

	Document Number	Date MM/YYYY	Country	Inventor Name	English Abstract		Transl. R Available
					Enclosed	No.	
GM	KR 59-228776	12/1984	Japan	Maefutsu et al.		X	FULL
GR	LR 56-080183	07/1981	Japan	Kobayashi et al.		X	
MR							
NR							
OR							
PR							
QR							
RR							

### OTHER (Including in this order Author, Title, Periodical Name, Date, Pertinent Pages, etc.)

GM	SR	Amano, <i>The Research on MOVPE Growth and Application to Photoelectric Physical Property of GaN and a Device Emitting Blue-Color Lights</i> , Doctoral Dissertation of Nagoya University, Chapter 7.8 (pages 80-94), January 13, 1989			X	Partial
	TR	Jacob et al., <i>Efficient Injection Mechanism for Electroluminescence in GaN</i> , Applied Physics Letter, Vol. 30, No. 8, pp. 412-414, April 15, 1977				
	UR	Tietjen et al., <i>Vapor Phase Growth Technique and System for Several III-V Compound Semiconductors</i> , RCA Laboratories, 5 pages, March 1969			X	Partial
	VR	Ta, <i>Photoluminescence Characterization of Shallow Impurities in GaN Grown by Chemical Vapor Deposition</i> , Dissertation for University of Southern California, pages 1-166, July 1981				
	WR	Wang, <i>Photoluminescence and Stimulated Emission from GaN</i> , Dissertation for University of Southern California, pages 1-158, November 1978				
GM	XR	Sayyah, <i>A Study of Growth Mechanisms and Electrical and Optical Properties of Epitaxial Al<sub>x</sub>Ga<sub>1-x</sub>N layers Grown by Atmospheric Pressure Metalorganic Chemical Vapor Deposition</i> , Dissertation for University of Southern California, pp. 1-176, February 1986				

Examiner

*S. Mulpuri*

Date Considered:

2/8/07

\*EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 608. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

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Applicant: MANABE et al.		
Appln. No.: 09/677,781		
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Examiner: S. MULPURI Group Art Unit: 2812		

**INFORMATION DISCLOSURE STATEMENT  
BY APPLICANT**

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Page 1 of 1

**U.S. PATENT DOCUMENTS**

Examiner's Initials*	Document Number	Date MM/YYYY	Name (Family Name of First Inventor)	Class	Sub Class	Filing Date (If appropriate)
AR						
BR						
CR						
DR						
ER						

**FOREIGN PATENT DOCUMENTS**

	Document Number	Date MM/YYYY	Country	Inventor Name	English Abstract	Translation Readily Available	
						Enclosed	No
FR	58-200527	11/1983	Japan			X	
GR	60-175468	09/1985	Japan			X	
HR	63-188938	08/1988	Japan			X	
IR	02-042770	02/1990	Japan			X	
JR							
KR							
LR							
MR							

**OTHER (Including in this order Author, Title, Periodical Name, Date, Pertinent Pages, etc.)**

NR	AZOULAY, R. et al., "Mocvd N-Type Doping of GaAs and GaAlAs Using Silicon and Selenium and Fabrication of Double Heterostructure Bipolar Transistor," <i>Journal of Crystal Growth</i> , Vol. 68, 1984, pp. 453-460.			
OR	BASS, S., "Silicon and Germanium Doping of Epitaxial Gallium Arsenide Grown By The Trimethylgallium- Arsine Method," <i>Journal of Crystal Growth</i> , Vol. 47, 1979, pp. 613-618.			
PR	HIRAMATSU, K., "Effects of Buffer Layer in Movpe Growth of GaN Film on Sapphire Substrate," <i>Nagoya University</i> , 1988, pp. 334-342.			
QR	KHAN M., "Effect of Si on Photoluminescence of GaN," <i>Solid State Communications</i> , Vol. 57, No. 6, 1986, pp. 405-409.			
RR	SZE, S., "Physics of Semiconductor Devices," <i>Wiley-Interscience</i> , 1969, pp. 42-43.			
SR	TIETJEN, J., "Vapor Phase Growth Technique and System for Several III-V Compound Semiconductors," <i>RCA Laboratories</i> , 1969, pp. 1-9.			
TR				
UR				
VR				
WR				

Examiner \_\_\_\_\_ Date Considered: \_\_\_\_\_

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